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SCIENCE AND TECHNOLOGY

No. 157

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CHINA REPORT

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CONTENTS

PEOPLE'S REPUBLIC OF CHINA

NATIONAL DEVELOPMENTS

Y-11T Twin Turboprop Utility Aircraft Shows Improved Design Features
(Xiong Wenjie; GUOJI HANGKONG, 5 Jan 82) 1

APPLIED SCIENCES

Chinese Character Computer-Laser Phototypesetting Described
(Yang Zhenyi; DIANZI SHIJIE, No 10, 1981) 8

Procedures for July 1982 National Census Explained
(Gan Binghuang; DIANZI SHIJIE, No 1, 1982) 15

Briefs
Liaoning Ice-Detecting Station 21
Liaoning Research Institute 21
Yunnan TV Work Develops 21
Xinjiang Wired Broadcasts 21
Shandong Scientific Conference 22

PUBLICATIONS

Table of Contents of 'DADIANJI JISHU' No 1, 1982 23

Table of Contents of 'JILIANG JISHU' No 1, 1982 25

Table of Contents of 'LIXUE YU SHIJIAN' No 1, 1982 27

Table of Contents of 'JIXIE ZHIZAO' No 2, 1982 30

ABSTRACTS

COMPUTERS

JISUANJI SHIJIE [CHINA COMPUTERWORLD] No 4, 20 Feb 82 32

ENGINEERING

CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] No 3, 1982 36

MECHANICS

LIXUE XUEBAO [ACTA MECHANICA SINICA] No 1, 1982 41

METALLURGY

JINSHU XUEBAO [ACTA METALLURGICA SINICA] No 1, Feb 82 49

NONDESTRUCTIVE TESTING

WUSUN JIANCE [NONDESTRUCTIVE TESTING] No 1, 1982.................. 58

NATIONAL DEVELOPMENTS

Y-11T TWIN TURBOPROP UTILITY AIRCRAFT SHOWS IMPROVED DESIGN FEATURES

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 1, 5 Jan 82 pp 7-9, 11

[Article by Xiong Wenjie [3574 2429 2638]]

[Text] Since the initial design and small-scale production of the Y-11 airplane in 1977, a great deal of experience has been accumulated in using the aircraft in agriculture and forestry such as spraying insecticides, feeding and seeding, forest fire prevention, and in geological exploration of rare minerals. The airplane has proven to perform well, particularly in terms of low altitude controllability, wide field of view, ease of maintenance, and operational simplicity. It can take off and land on short, unpaved runways, and is well liked by most users. Over the years, the Y-11 has proven to be a multifunction light aircraft with outstanding performance. Recently, plans were made to install heating equipment and fish-eye windows on the Y-11 in order to meet operational needs in northern China.

With the growth of the national economy, new demands are constantly being placed on multifunction small airplanes. In geological exploration, an airplane is desired to serve as an airborne observation station capable of performing simultaneous measurements using various physical techniques; there is a need to install high precision positioning and navigation equipment in order to satisfy the needs of low altitude, large scale aerial surveillance. The airplane is required to operate not only in the valleys of southeastern China but also over the highlands of southwestern and northwestern China. For short-range transportation, it is desired to increase the payload and range of the Y-11 without sacrificing its performance. In order to satisfy these new demands, significant design improvements have been made to the Y-11 to produce the twin-engine, turboprop Y-11T. The two "PT6A" engines on the Y-11 were replaced by two "PT6A-10" turboprop engines; the gross weight of the airplane was increased from 3,250 kg to 5,000 kg; and the maximum payload was increased to 1,700 kg. The new airplane has a high lift-to-drag wing design and a fuel tank integrated with the wing structure; it is also equipped with a Doppler radar and other high precision navigation equipment. In addition, improvements were also made on many other aspects of the airplane.

In recent years, as a result of the rapid increase of fuel prices caused by the energy crisis, there is a trend to replace jet passenger planes by medium or small turboprop airplanes for short-range transportation. Thus, the so-called branch-route or commuter airplanes have experienced rapid growth. This type of airplane is much more economical to operate than a large passenger plane for ranges of less than 400-600 km.

The Y-11T not only meets the requirements of geological exploration and other functions, it can also serve as a modern commuter passenger airplane. It has a wide cabin, requires short take-off and landing runways, and accommodates 17 passengers. It completely meets the U.S. Federal Aviation Regulation FAR-23 for passenger airplanes.

The powder and liquid spraying techniques (including both normal spraying and ultra-low volume spraying) which had been fully tested on the Y-11 airplane can be used on the Y-11T for insect prevention in agriculture and forestry. The increased cargo bay of the Y-11T can store grass seed or tree seed which is used to transform meadowland or to make green China's northwestern highlands.

The primary functions of the Y-11T airplane are: short-range transportation, geological and resource exploration, farming operations, air drop and parachute operations. Its main technical data are as follows:

length	14.86 m
height	5.275 m
wing span	17.24 m
wing area	34.27 m^2
passenger cabin dimensions (height x width x length)	1.7 x 1.6 x 4.9 m^3
cargo opening (width x height)	1.45 x 1.38 m^2
gross weight	5,000 kg
empty weight	2,800 kg
maximum fuel capacity	1,200 kg
maximum payload	1,700 kg
maximum cruising speed	282 km/hr
climb rate (H=0)	6.3 m/sec
take-off distance	220 m
landing distance	210 m
maximum range (with 45 minutes fuel reserve)	1,280 km

The Y-11T airplane has a twin-engine, single high wing, single vertical tail design with fixed three-point landing gear. Each of the two PT6A-10 engines has a rated power of 475 hp; the propeller has three blades each with a diameter of 2.36 m, and is equipped with a mechanism to allow forward and reverse motion. The rectangular wing is of dual cantilever structure supported by two inclined rods; its wing profile belongs to the high lift-to-drag ratio GA-0417 type airfoil design, with a relative thickness of 17 percent. In order to improve low-speed and take-off and landing performance, the front section of the wing is equipped with automatic leading edge flap; the rear section is equipped with retractable Fuller flaps and ailerons. The wing section contains an integrated fuel tank with a maximum capacity of 1,600 liters.

The fuselage of the airplane has a rectangular cross section with rounded edges; its cabin is roomier than most airplanes of the same class. The height is 1.7 m, the maximum width is 1.6 m, the length is 4.9 m, and the volume is 13 m^3. The front and rear sections of the airplane have cargo bays whose capacities are 0.77 m^3 and 1.89 m^3 with maximum loads of 80 kg and 220 kg respectively. On the sides of the airplane are four windows each 0.61 m wide. At the left rear section of the cabin is a door 1.45 m wide and 1.38 m high for loading oversized cargos or for parachute operation. Opposite to the cargo bay is a 0.68 m x 0.66 m emergency window. This window can be enlarged to allow 14 parachutists to jump from both sides of the airplane during a parachute operation.

When used as a passenger plane, the Y-11T can accommodate 17 seats. When used as a cargo plane, it has 11 retaining rings on the floor to tie down cargos. The load capacity of the floor is 750 kg/m^2.

Throughout the Y-11T metallic epoxy glue techniques are extensively used. Pure metallic glued joints have several advantages over riveted joints or spot-welded joints.

1. Higher fatigue strength. Since there is no stress concentration as in rivet holes or weld points, the force distribution over a glued surface is more uniform and the fatigue strength can be increased considerably.

2. The critical stress of a glued structure under load conditions has been shown experimentally to be 30 percent higher than that of a riveted structure.

The epoxy glue used on the Y-11T is the "Self Reliance-2," which has been tested in industrial use for many years. The airplane wing has over 70 percent glued surfaces. The fuel tank section between the main spars and the upper and lower ribs beneath the main spars are also glued. Forty percent of the long struts and skin of the fuselage are also glued; this proportion will be further increased when the airplane goes into mass production.

Since the early 1970's, glued joints have been used on nonstress parts of military aircraft. Sample parts retrieved after many years of use were subject to shear stress test; the results show that even though the parts were aged and used, the basic strength characteristics did not change.

The integrated fuel tank is situated between the 6th and 17th rib of the left and right wing. Its overall capacity is 1,600 liters. The 6th rib and the 17th rib are made of hard aluminum plates which are machined with a numerically controlled milling machine. In the top rear section of the fuel tank is a large, removable cover plate to allow inspection. Both the top and bottom plates are sealed to the main spars and the side ribs by injecting glue into milled grooves on the flanges. The top end of the wing support rod is connected to the 10th rib which is milled from a solid plate, and to the 4th long strut of the lower plate. With this type of structure, the wing loading is transmitted through the support rods to the winglet. During flight the glue joints of the support are subject to both shear stress and compressive stress, resulting in a tight seal at the glue line.

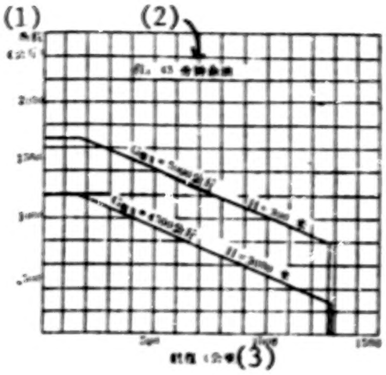

Figure 1. Payload Versus Range Plot for the Y-11T

Key: (1) payload (kg)
(2) note: 45 minutes of fuel reserve
(3) range (km)

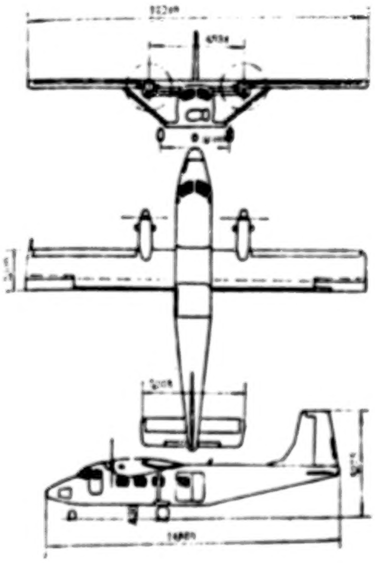

Figure 2. Front, Top, and Side Views of the Y-11T Airplane

The main components of the Y-11T airplane were subject to extensive design tests before the first prototype was produced, i.e., a full-scale sample of each component was made and tested for performance and strength. The main components include:

1. The integrated fuel tank. In addition to kerosene seal test under pressurized conditions, static strength tests of the fuel tank were conducted under 100 percent design load conditions. After maximum load tests, the seals of the glue joints were found to be satisfactory.

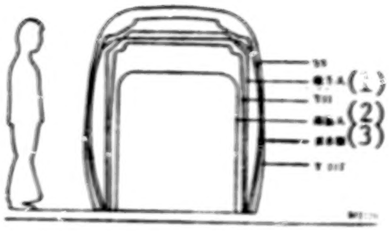

Figure 3. Comparison of Cabin Cross Sections of Several Airplanes

Key:
(1) the Shepherd
(2) the Islander
(3) the Twin Beaver

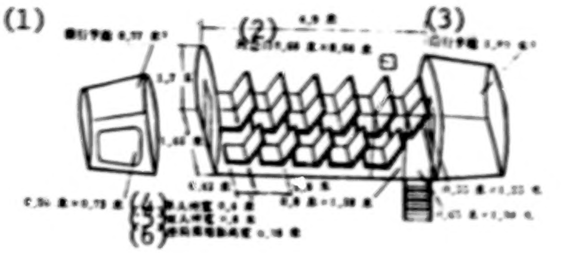

Figure 4. Diagram of the Cargo Bay and Passenger Cabin of Y-11T

Key:

(1)	front cargo bay	0.77 m
(2)	emergency exit	0.68 x 0.66 m
(3)	rear cargo bay	1.89 m^3
(4)	single seat width	0.4 m
(5)	double seat width	0.8 m
(6)	seat height above floor	0.38 m

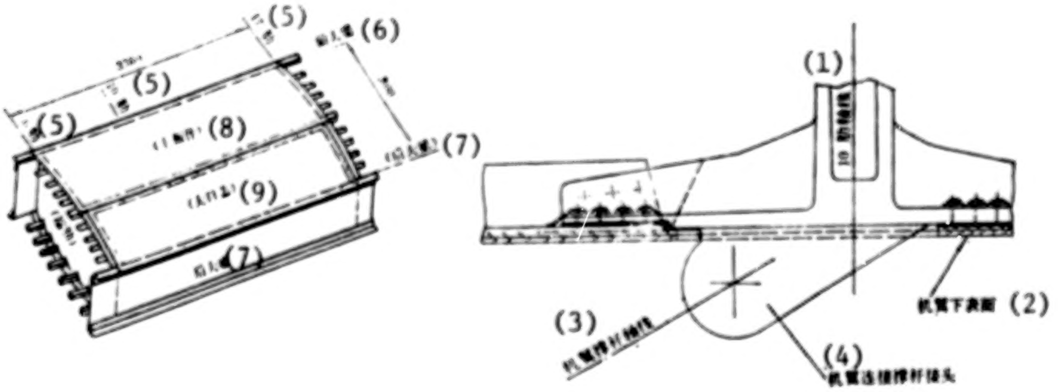

Figure 5. Integrated Fuel Tank

Key:
(1) rib axis
(2) lower wing surface
(3) support rod axis
(4) joint between support and wing
(5) ribs
(6) front spar
(7) rear spar
(8) top plate
(9) large cover plate

2. The new GA-0417 wing profile was flight tested a year ago on the Y-11 airplane; currently a more complete performance test program is underway. Preliminary results indicate good flight characteristics. Under similar conditions, the new wing profile can increase the maximum speed by 3 percent and the climb rate by more than 10 percent.

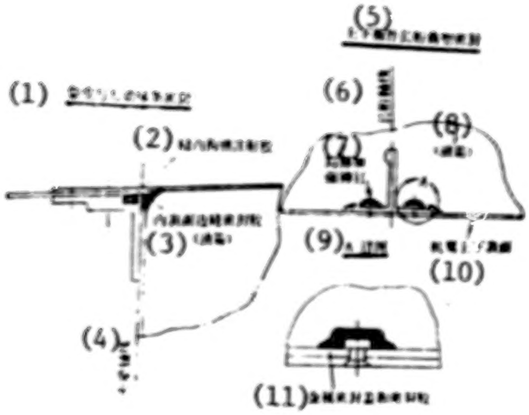

Figure 6. Seal Design for the Joint Between Support Rod and Wing

Key:
(1) seal between cover skin and main spar
(2) inside groove for injected glue
(3) seal on interior surface (fuel tank)
(4) main spar axis
(5) typical seal for long strut for top and bottom plates
(6) long strut axis
(7) locally reinforced rivets
(8) fuel tank
(9) cross section A
(10) upper and lower wing surface
(11) metallic cover and sealing glue

3. The control system of the flap extension and retraction consists of an electric motor, torsion rod, steel cable, pulleys, and rail tracks. This system was also subject to full-scale simulation tests on the ground, and also flight-tested extensively on the Y-11 airplane. On the Y-11T, the steel cable is to be replaced by chains. Before the first flight test of the prototype airplane, complete simulation tests will be conducted on the ground to ensure its reliability.

4. The load conditions of the wing and the support rod are basically the same as those for the Y-11 The Y-11 has accumulated 2,200 flight hours, and ground fatigue tests have accumulated close to 20,000 flight hours, providing a large amount of valuable data on structural load fatigue characteristics. The experience gained from carefully analyzing these data has been incorporated in the structural design of Y-11T. Structural fatigue tests of the Y-11 are currently still being conducted; in the future, new load spectrum will be used to perform fatigue tests on the fuselage structure.

The first three experimental models of the Y-11T have gone into production. The first airplane will be used for full-scale static strength tests; the second and third airplanes will be used for flight tests. It is anticipated that the strength tests and overall assembly will be completed by this spring; flight tests will commence before May.

At present the Ministry of Geology has placed orders for two Y-11T's. These airplanes will be equipped with electric, magnetic, and radioactive devices for geological exploration, as well as navigation equipment to provide high precision measurements.

The designs of the passenger model and the parachute model will commence in 1982. It is expected that exhibition flights of these airplanes can take place around the country by early 1983.

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CHINESE CHARACTER COMPUTER-LASER PHOTOTYPESETTING DESCRIBED

Beijing DIANZI SHIJIE [ELECTRONIC WORLD] in Chinese No 10, 1981 pp 2-4

[Article by Yang Zhenyi [2799 6297 0001]: "A Revolution in Editing and Composing Techniques--Computer-Laser Phototypesetting"]

[Text] In the marvelous world of electronics, the emergence of the computer has deeply affected science, the economy, the military and even people's daily lives. In the field of printing and publishing in recent years, the computer has been combined with laser technology, bringing printing techniques from the era of "lead and fire" to an era of "light and electricity," and this has opened up a bright future for the printing business.

The Development of Composing Techniques

About 900 years ago, our nation's Hua Sheng invented movable type printing. Later, lead type was developed in the West. This lead type printing technology was complex. It required high-temperature typefounding, manual typesetting and composing, and high-temperature casting processes. This technique was labor-intensive. Its efficiency was low. It was very difficult to change the composition. Sometimes, it caused lead poisoning in workers. Therefore, for a long time, people continued to study ways to renovate this technique.

During the past 30 years, as photography developed, phototypesetting emerged.

In the beginning, people put type on fonts. The type was manually located on the fonts, and then it was photographed on film. This was the first generation of typesetting. Because the entire process was manually operated, it was also called manual phototypesetting. It can be imagined that the efficiency of this kind of phototypesetting was not high. It only eliminated the use of lead type.

The emergence of the computer has had a decisive effect on the development of phototypesetting. In 1958, an American invented the computer-controlled automatic typesetting machine. It uses the computer to issue commands to control the movement of the font, to automatically select the type, and to photograph each letter consecutively to form the page. This was the second-generation phototypesetting machine. It was also called the photomechanical typesetting machine. Although the operational speed of the computer was very high, the speed of mechanical movement was relatively slow, and the two did not match. Therefore efficiency did not visibly improve with this kind of phototypesetting machine.

In 1965, a West German used a brand new idea to design and develop the third-generation phototypesetting machine. He digitized the type and stored it in the memory of a computer. The computer then scans the dots and a cathode ray tube displays the characters (letters), and the characters are then photographed on a page.

Digitization of type means to represent type by a string of numbers consisting of "1" and "0." For example, a character is traced on a piece of graph paper. The squares covered by the strokes are designated as "1" from left to right and from top to bottom in order. The squares not covered by the strokes are designated "0." Conversely, we can also designate all squares covered by the strokes as "0" and all squares not covered by the strokes as "1." The arrangement of "1" and "0" forms a digitized message which is also called a dot matrix type. Such a message can be entered into the computer. Of course, the smaller the squares, the higher the quality of the type and the more digits the message of the type will have. Figure 1 shows a simple 24 x 24 dot matrix type.

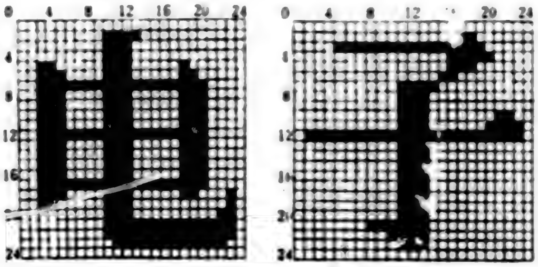

Figure 1. Simple 24 x 24 Character Matrix

Compared to the second-generation phototypesetting machine, the efficiency of the third-generation typesetting machine is much higher, but it requires a cathode ray tube and film of very high resolution and quality.

In recent years, laser technology has developed rapidly. The British first used laser technology in phototypesetting. In 1976, the British first successfully developed the fourth-generation typesetting machine. It uses the computer to control laser beams which directly scan the photographic film and expose the film to form the layout. Because the laser beam is very thin and its intensity is high, it has a relatively high resolution, and it does not require special film. At present, Britain's Monotype Company is beginning to produce a few units of this fourth-generation phototypesetting machines for Western languages and is experimentally converting the machine into a Chinese character phototypesetting machine.

The Chinese character editing and composing system successfully developed by such units as our nation's Beijing University belongs to this presently most advanced fourth-generation phototypesetting system. This system's main structure consists of a small general-purpose computer, a small dedicated computer and a roller type laser phototypesetting machine with four parallel laser beams.

The Key to Chinese Character Typesetting

In recent years, a lot of research has been conducted domestically and abroad in Chinese character information systems, but most are simple systems for business management, office automation and information search. They generally use a 32 x 32 or 24 x 24 matrix or even a 16 x 16 matrix, i.e., they use several hundred to a thousand dots to represent one Chinese character. The quality of these characters is relatively low and they cannot be used for printing books and newspapers.

To insure that the form of the characters of printed material is beautiful and the strokes are clear, the density of the dot matrix of the characters for newspapers and for books must be above 20 dots and 25 dots, respectively. This means that each Chinese character in the text must be composed of 10,000 dots and a character of a headline must have over 300,000 dots. Ordinary printing of books and newspapers requires over a dozen different typefaces and over a dozen different type sizes. If there are 7,000 characters for each small type size and 4,000 characters for each large type size, there will be a total of 650,000 characters which require 20 billion bits of storage. Such a huge amount of type information cannot be handled by simple Chinese character processing systems and Western language phototypesetting systems. Even if we used large magnetic disc storage with several billion bits, we would still need a dozen to store all the information. The large-capacity magnetic discs are large in size and costly. Their storing and accessing speed is slow, and they cannot satisfy the requirements. Therefore, how to reduce the amount of stored information of Chinese character type has become the key to developing the Chinese character phototypesetting technique.

Foreign nations have conducted many studies to reduce the amount of storage of Chinese character type. For example, they have used a method of recording the beginning position and length of the darkened squares covered by a stroke, i.e., the so-called "black segment white segment method." But these methods all have a very low magnitude of compressibility, or else, after compression, the quality of the characters is very poor, and they have not been practical. Beijing University has successfully developed a technique to compress Chinese character information. Its magnitude of compression is high and it insures the quality of the characters. It can reduce the amount of information per character of ordinary text size (No 5 character) by 12 times, i.e., reducing from 10,000 bits down to an average of 800 bits; it allows the characters to become larger or smaller, longer or flatter; and it can also insure quality. In this way, the whole magnitude of compression can reach 500 times, and only 4-megabyte storage is needed to store all the information of over 600,000 Chinese characters. The compressed information is fed through a specially designed Chinese character dot matrix generator operated by a microprogram. The original Chinese character dot matrix is thus quickly restored without causing any distortion. Thus the difficult problem of storing Chinese character information has been satisfactorily solved.

The information in the Chinese character type library is generally stored character by character and provided character by character. But a laser cannot scan character by character. It can only scan line by line. This has presented difficulty for composing complex layouts. It is not practical to store nearly 100 million bits of dot matrix information of a page of newspaper in a buffer memory because the speed of doing so is too slow and the cost is too high. Therefore, Beijing University has developed a method of combining software and hardware. The software provides the layout and editing information to the hardware. The hardware forms the layout at high speeds according to the editorial information. As a result, this difficulty has been solved using a very small-capacity buffer memory.

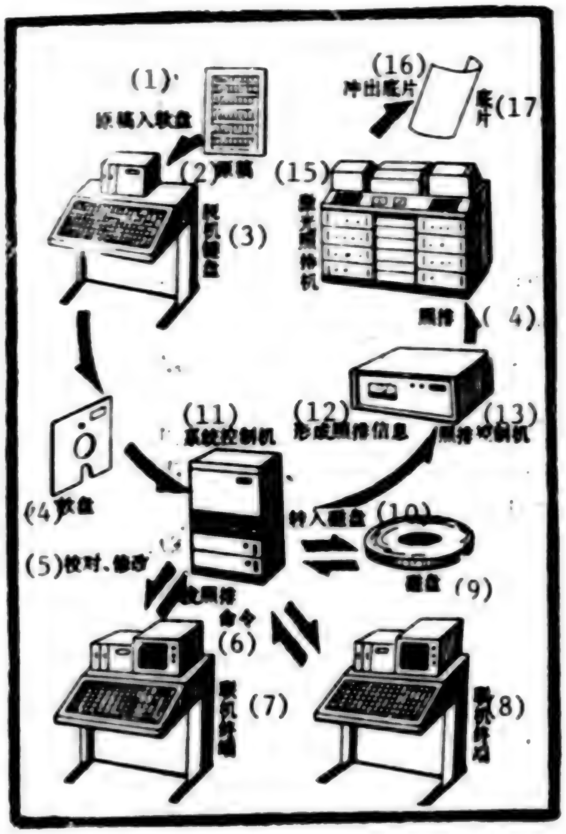

Figure 2

Key:

(1)	Original text is recorded on flexible discs	(9)	Magnetic tape
(2)	Original text	(10)	Transfer to magnetic tape
(3)	Offline keyboard	(11)	System controller
(4)	Flexible disc	(12)	Forming phototypesetting message
(5)	Editing, revising	(13)	Phototypesetting controller
(6)	Issue commands for phototypesetting	(14)	Phototypesetting
(7)	Online terminal	(15)	Laser phototypesetter
(8)	Online terminal	(16)	Developing the film
		(17)	Film

Phototypesetting Process

Lead type printing generally goes through the processes of selecting the type, printing a proof, editing the proof, composing the layout, changing the layout, and printing. Similarly, using the computer-laser Chinese character editing and typesetting system requires text input, editing, revising, layout designing, composing, and phototypesetting, as shown in Figure 2.

1. Text input. The operator inputs the text with various typesetting commands into the computer via the Chinese character keyboard.

The typesetting commands are information indicating the typeface, the type size and the layout of the text on the page. They are inserted in the text by the editor before hand and they are input into the computer together with the text.

The Chinese character keyboard can be divided into a large keyboard, a medium keyboard and a small keyboard. The large keyboard generally has several thousand Chinese characters. Each key represents one Chinese character. Striking one key enters one Chinese character. The computer receives the code corresponding to that key. To improve efficiency, some keyboards also have phrase composition keys. Striking one of these keys inputs a corresponding group of Chinese characters. Characters not on the keyboard are called extra-keyboard characters, and they require special processing. These keyboards are easy to use but they require the operator to remember the position of every Chinese character on the keyboard. The medium keyboard and the small keyboard only have several dozen to several hundred keys. Each key represents one of the radicals of Chinese characters or a letter of a Western language. This keyboard requires the operator to memorize very little, but generally several keys must be pressed to compose one Chinese character and the rules of composing the characters are relatively complex.

At present, large, medium and small keyboards are all being used, and the same keyboard also has several different input schemes. In general, they are more complex than Western language input. This is because Chinese characters themselves are more complex, and there are a great many.

Regardless of which kind of keyboard, they can all operate online or offline. In the former case, the keyboard codes are directly entered into the computer. In the latter case, the keyboard codes are first recorded on a flexible magnetic disc or punched paper tape, then these are read by an input device and the information is input into the computer.

2. Editing and revision. Editing and revision of a text are carried out on a "Chinese character terminal." The Chinese character terminal is a microprocessing system, generally consisting of a microprocessor, a Chinese character keyboard, a Chinese character display, a pin type printer and flexible magnetic discs. People use the Chinese character terminal to access the text stored in the mainframe or on the magnetic discs of the Chinese character terminal for display on a screen. Then the original text is edited by adding text, deleting text, changing text, inserting text, dividing the text into

paragraphs or combining paragraphs via the keyboard. A proof can also be printed out by the printer for offline revision, and then the operator can enter the corrections into the computer via the keyboard according to the revised proof. A Chinese character editing and typesetting system frequently has several, a dozen or even several dozen online terminals for simultaneous correction and revision of text. The corrected and revised texts are all stored on magnetic tapes of the mainframe to await typesetting.

3. Layout design. The editor issues the typesetting command to the mainframe via the terminal. The mainframe automatically organizes the layout according to the typesetting commands written in the original text via the present typesetting software and displays the layout on the screen. The editor uses the layout revision command to conveniently revise the layout. The revised layout is then displayed.

4. Editing and phototypesetting. After the editor is satisfied with the layout, he can issue commands to prepare for phototypesetting and issue phototypesetting message according to requirements, then it automatically paginates the text and automatically adds a page number at the end of each page. It also automatically recognizes and prohibits printing of certain characters at the end or the beginning of sentences. This means that if a comma or a period appears at the beginning of a line or a beginning quotation mark appears at the end of a line, the computer will automatically enlarge the distance between foregoing words or characters or appropriately compress the spacing of the punctuation marks for adjustment. During phototypesetting, the computer accesses from the library the required type, and according to the editing message, phototypesets the text. Because the amount of information on one page is large, the computer cannot and need not send information on the whole page to the laser phototypesetting machine at one time. The actual situation is that this system has a double buffer zone which sends phototypesetting information and performs phototypesetting simultaneously.

Figure 3 shows a roller type phototypesetting machine. During phototypesetting, the film is placed on a cylindrical roller and is rotated at even speed. The transverse sliding plate with a lens on it slides along the axial direction of the roller at even speed. The phototypesetting signal controls the light regulator in the laser phototypesetting machine so that the light beam is turned on or off. The light beam is focused by the lens on the transverse sliding plate onto the film and the film is exposed. As the roller rotates, the light beam is turned on and off and the transverse sliding plate moves back and forth. The three combine to expose the film and form the layout on film. Then the exposed film is developed for making a plate for printing.

The phototypesetting speed of the laser phototypesetting machine is 50 characters per second. Typesetting an octavo newspaper page requires 1.5 minutes.

The whole procedure above is carried out under the control of large-scale software. This large-scale software includes a time-shared operating system, typesetting and editing programs, and programs to process commands and to control the terminals.

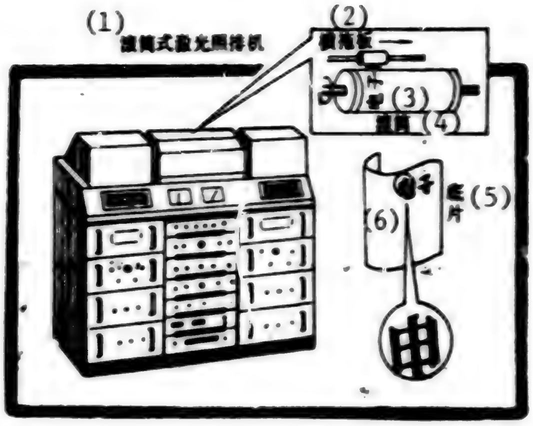

Figure 3

Key:

(1)	Roller type laser phototypesetter	(4)	Roller
(2)	Transverse sliding plate	(5)	Film
(3)	Chinese character dian zi	(6)	Chinese character dian zi

We can see from this that to realize automatic phototypesetting, we must not only have computers, laser phototypesetting machines; we also must have matched Chinese character terminals and we cannot do without software. Their close combination and coordination form an organic whole. Therefore, people frequently do not call it a phototypesetting machine anymore, but more accurately an "editing and typesetting system." It has brought about revolutionary progress in the techniques of editing and typesetting.

9296
CSO: 4008/88

APPLIED SCIENCES

PROCEDURES FOR JULY 1982 NATIONAL CENSUS EXPLAINED

Beijing DIANZI SHIJIE [ELECTRONIC WORLD] in Chinese No 1, 1982 pp 4-5, 15

[Article by Gan Binghuang [3927 3521 3552]: "Our Nation's Third General Census and Computer Technology"]

[Text] Major Significance, Heavy Task

In March 1981, the Chinese Communist Party Central Committee and the State Council decided to conduct our nation's third general census on 1 July 1982. This is an event of unusual significance and it has attracted worldwide attention. The United Nations has appropriated funds to help and has sent experts to our nation to lecture and guide us.

A census is taken to record information regarding the population scattered throughout the nation at a particular time. The information is then processed and compiled into tables and used to produce statistics. A census must not only count the number of people, it must also clarify the population distribution and the structure of manpower resources and understand the people's needs. This is used as a reference for drawing up national economic plans and such major decisions. Therefore, many nations place a lot of emphasis on the census and legally establish the taking of the census at fixed intervals. For example, the United States and Japan have both established the practice of taking a national census every 10 years.

Since the founding of the nation, our nation has conducted a nationwide census twice, in 1953 and 1964. The current census is characterized by a large-scale and has more items than the previous two. Since the second census, our nation's population has increased on a large scale. To clarify the situation of so many people in a very short time requires a lot of manpower and the scale is unprecedented. This census includes household records (5 items) and personal records (14 items).

Family records include: type of household, house number, number of people in the household, number of people born last year, and number of people permanent residence but absent for over a year. Personal records include: name, relationship to head of household, sex, age, place of birth, nationality, education, profession, occupation, absent from work, marital status, number of living and married females and children of child-bearing age, number of births by women of child-bearing age, head of household and living conditions. In addition, there are 5 items relating to address codes--totaling 24 items, an increase of 19 items and 16 items over the first and second census respectively.

This census will produce over 300 types of various statistical reports from the statistical material to be gathered. According to statistics of test points, certain items in one personal record are used several hundred times in various reports and tables; the number of times used can reach about 1,000. On the basis of a national population of 1 billion, if all the data were to be calculated using an abacus or a calculator, the compilation of all data would require 50,000 to 60,000 people working day and night continuously for 7 to 8 years. The data obtained in this way would not be meaningful. Thus, people very naturally thought of the master of data processing--the computer.

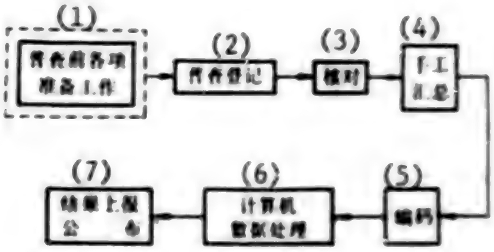

Figure 1. Procedures of a Population Census

Key:

(1) Preparatory work for a general census
(2) General census recording
(3) Checking for correctness
(4) Manual summary
(5) Coding
(6) Computer data processing
(7) The results are reported to higher authorities and published

The Computer Joins the Battle; One Serves as a Hundred Men

A census is very complex and detailed work. Its basic procedure is shown in Figure 1. It can be seen from Figure 1 that the computer mainly participates in summarizing the census. Because the computer does not recognize Chinese characters, but only Arabic numerical codes, therefore, the various items of the general census records must first be coded and translated into symbols recognizable by the computer, and the coding work must be completed first. For example, in sex, we first define male as "1" and female as "2." In the level of education, we define a university graduate as "1," a university student or a university dropout as "2," a highschool student as "3," a junior middle school student, elementary school student, a literate person and an illiterate person as "4," "5," "6" and "7" respectively. The following is a hypothetical example. A certain family has only 1 person, living at Pingyuanli of the Baithifang Street Office in Xuanwu Ward in Beijing, male, age 54, Han nationality, native of Beijing, elementary school education, cook at the steel and iron plant, married. Translated into codes, the census record would be as follows:

Family Record

1 1101010042801 001 001 00 000

1. Family household
2. Address code
3. Number of house
4. Number of people in household
5. Number of persons born last year
6. Number of persons with permanent residence but absent for over a year

Personal Record

3 001 01 1 054 11 01 5

7. Personal record label
8. Number of persons
9. Head of household
10. Male
11. Age
12. Birthplace, Beijing
13. Han nationality
14. Elementary school

01002 2 05255 0 2 0 0 1

15. Steel and iron profession
16. Ownership by the whole people
17. Cook
18. On the job
19. Married
20. Women item
21. Permanent resident household

The census record is compiled in the above form and then sent to the computer station for processing. Finally, the data are summarized according to various different types of results which are reported and published.

The experiment in using the computer to summarize the census of Beijing city in 1981 was good. This trial involved a census of 135,000 people. The census taking and the coding of the data took 1 month. Input of the data into the computer took less than 10 days. The computer's processing time was less than half a day. According to estimates, after this year's general census work begins, several thousand people will be working at the computer stations throughout the nation, and the work of the third census will be completed in about a year and a half. After the computer joins in summarizing the census data, work efficiency will be improved several hundred times.

Ordered and Busy But Not Chaotic

The whole procedure of using the computer to process census data is shown in Figure 2. It is carried out in three steps, recording, compiling and tabulating. The work is ordered and busy but not chaotic.

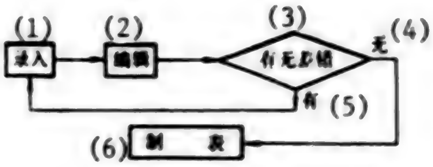

Figure 2. Computer Work Procedure

Key:

(1)	Input	(4)	No
(2)	Compilation	(5)	Yes
(3)	Are there errors?	(6)	Tabulation

First, the already coded census forms are sent to the computing stations of each province and city. The operator enters all of the census data by family, by person and by item onto the computer's magnetic discs via the keyboard. This step is simply called recording. The quality of recording directly affects the reliability of the final results. This work is characterized by a large amount of work, a long period and a high demand for quality. Generally, the amount of computer input is mostly calculated in characters (an Arabic numeral is called a character). Calculating a population of 10 million in Beijing city (average of 4 per family), the entire data will have 4 million characters. This requires 40 to 50 operators to record the data continuously for more than 470 days before the work can be completed, and the input error is under 0.05 percent. Data input work will occupy over 95 percent of the data processing time.

Second, editing. Before the computer begins data processing, the general census forms have to pass through many procedures. With a large amount of data input and a tight schedule, the speed must be fast, so the data recorded in the computer will surely contain mistakes. This requires the computer to help people check mistakes. This process is called editing. Editing mainly has three functions: one is logical error correction; the second is error checking; the third is to recompile all data into data satisfying the requirement of the tables. For example, it is not possible for males to give birth, and a husband and wife must be male and female. When a case of a male giving birth or husband and wife of the same sex are encountered, this is a logical error. When this type of problem is encountered, the machine will automatically make corrections according to human rules. Of course, the data corrected by the machine may or may not coincide with the actual situation, but logically it is rational and we can believe that it is correct. The second is the checking of general mistakes, such as inconsistency in the large and small classifications of the profession and the vocation, etc. When the machine discovers an error, it will print out the mistaken information and the machine will return to the input mode. The operator will compare it with the primary records for correction until there are no mistakes, and then the data which have been edited will be recorded on magnetic tape and handed over to the next procedure.

Also, there is tabulation. The computer will print out the needed tables according to human urules after summarizing the data. The tables of the third census are divided into four levels: the commune level (in cities, this level is the street office level); county and city level; the provincial level, which inclues provinces, municipalities, and autonomous regions; and the national level. The flow chart from summary to printout is shown in Figure 3.

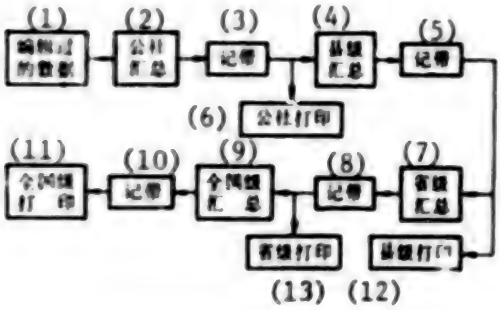

Figure 3. Flowchart From Summary to Printout

Key:
(1) Compiled data
(2) Commune summary
(3) Record on magnetic tape
(4) Commune printout
(5) County level summary
(6) Record on magnetic tape
(7) Provincial level summary
(8) Record on magnetic tape
(9) National level summary
(10) Record on magnetic tape
(11) National level printout
(12) County level printout
(13) Provincial level printout

It can be seen from Figure 3 that summary at the commune level involves gathering data directly from the general census and summarizing the information according to the reports and tables needed. The results of the summary must be recorded on magnetic tape to serve as data for county level summary. The data is then summarized again by the county level, recorded on magnetic tape, and so on up to the national summary. Besides the summaries at each level, every level relies on the commune level as the foundation, and different reports and tables are made at each level. Therefore, if an error occurs in the commune level summary, it will affect the correctness of the summaries at the subsequent levels.

The number of reports and tables of summaries at each level is not the same. Taking the data of the 1981 partial provincial and municipal general census stations as an example, the commune level summary included a total of 41 tables, of which 7 were printed. The county level summary was printed out in 64 tables. The provincial level summary was printed out in 69 tables. The national level summary was printed out in 72 tables (not including 17 tables on death statistics).

To fully develop the function of the computer, a large group of software personnel is needed. According to national regulations and requirements, they must compile various general census programs for computer data input. At present, computer operation, training of software personnel, compilation of software and various other types of preparatory work are being carried out intensively. We believe that under the guidance of the Central Committee of the Chinese Communist Party and the State Council, with the support of the people of the whole nation and international help, and with the computer as a powerful assistant, our nation's third general census will surely be completed successfully.

9296
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APPLIED SCIENCES

BRIEFS

LIAONING ICE-DETECTING STATION--An ice-detecting radar station, the first of its kind in China, has been completed and put into operation in Liaodong Bay of Bohai Sea. Operations during the past 2 months show that the station's equipment works well and can accurately detect ice at sea. Data obtained by the station will be used in seaport construction, maritime transportation and seabed oil exploration. [OW151335 Beijing Domestic Service in Mandarin 1200 GMT 6 Feb 82]

LIAONING RESEARCH INSTITUTE--Shenyang, 6 Feb (XINHUA)--Scientists of the Shenyang-based Institute of Metal Research have succeeded in producing the thermal decomposed graphite grid, a transmission tube for high power radio stations. The pyrolysis graphite gride has already been installed in China's overseas radio service, according to Professor Shi Changxu, 62, director of the institute under the Chinese Academy of Sciences. Professor Shi said that the transmission tube was one of 18 major projects developed by the institute last year as part of its effort to support the nation's economic development. The professor said that scientists of the Laboratory of High Temperature Alloys and Special Castings had produced in a half-year span a special wear-resistant alloyed plate for the rolling mill of the Xinfu steel plant in Fushun, which raised working capacity threefold and saved the state a fund of 600,000 yuan annually. [OW151335 Beijing XINHUA in English 0748 GMT 6 Feb 82]

YUNNAN TV WORK DEVELOPS--Over the past 2 years, TV work in Yunnan Province has developed quickly. The province has now built 219 TV relay stations, which can transmit TV programs to an area of 100,000 square kilometers. In the province, localities in 17 prefectures, autonomous prefectures and municipalities and 106 counties can watch TV programs. The province now has about 210,000 TV sets. [HK040612 Kunming Yunnan Provincial Service in Mandarin 1100 GMT 1 Feb 82]

XINJIANG WIRED BROADCASTS--On the morning of 11 March, Wang Enmao, Ismail Amat and Tomur Dawamat, leading comrades of the Xinjiang Autonomous Region, and advisers met all participants of the appraisal meeting for outstanding broadcast programs of the regional wired broadcasting system. In his speech, Comrade Wang Enmao fully affirmed the achievements scored in propaganda work by the wired broadcasting stations in various localities of the region. He also encouraged the participants to maintain their efforts in this work so as to educate and urge the people of all nationalities to make new contributions to building socialist material and spiritual civilization. Also at the meeting were responsible comrades of the propaganda department of the regional CCP committee and regional broadcasting bureau. Since last year the wired broadcast stations in various counties and municipalities have started to broadcast their own programs as well as relaying the programs of the central people's broadcasting station and the regional station. The county and municipal wired broadcasting stations have closely linked their own programs with the actual state of ideology, production and life of the local people to publicize the party's line, principles and policies and popularize scientific and cultural knowledge for enriching rural cultural life. All this has been welcomed by the local people of all nationalities. At the appraisal meeting, awards were presented for 63 excellent programs in five languages: Uygur, Han, Kazakh, Mongolian and Kirgiz. [Excerpts] [HK120549 Urumqi Xinjiang Regional Service in Mandarin 1650 GMT 11 Mar 82]

SHANDONG SCIENTIFIC CONFERENCE--The provincial conference on dissemination of scientific and technological knowledge in rural areas concluded on 27 February in Jinan after a 5-day session. The conference pointed out that we should further shift the emphasis of this work to rural areas to help raise the rural farming level and accelerate the province's agricultural development. Zhao Lin, secretary of the provincial CCP committee, and (Yang Pei), vice minister for dissemination of scientific and technological knowledge, attended the meeting and spoke. The conference contended that, since the third plenary session, the province's scientific and technological work has taken on a new aspect and is entering a new period. According to statistics, the province sponsored 250 refresher and training classes of all kinds which turned out 21,600 backbone technological cadres. These cadres have been playing a positive role in agricultural production. The conference discussed ways to accelerate dissemination of scientific and technological information at a time when the rural areas are universally implementing the responsibility system. It contended that we should continue to implement the contract system on application of farming techniques with remuneration calculated on the basis of output. This system is an extension of the responsibility system and a good measure to accelerate dissemination of new farming techniques. The various localities should further sum up experiences, gradually improve this system and widely adopt it. [Excerpt] [SK280839 Jinan Shandong Provincial Service in Mandarin 2300 GMT 27 Mar 82]

CSO: 4008/130

TABLE OF CONTENTS OF 'DADIANJI JISHU' NO 1, 1982

Harbin DADIANJI JISHU [LARGE ELECTRIC MACHINERY TECHNOLOGY] in Chinese No 1, 1982 preceding p 1

[Text] The 1700 mm Hot Strip Mill Motors Installed in Benxi Iron and Steel Plant......Gao Wenying [7559 2429 5391], Harbin Electrical Machinery Plant (1)

Changed-pole Methods by Changing Direction of a Single Winding and Its Analyses of MMF Harmonics......Chen Qiaofu [7115 0829 1133], Huazhong Institute of Technology (6)

Cause of Bending and Angular Deformation on the Pole Core of Hydrogenerator......Du Chaosheng [2629 3390 3932], Tianjin Electrical Generating Equipment Plant (19)

Determination of the Reasonable Construction of the Turbogenerator Retaining Ring by the Finite Element Method...... He Linan [0149 7787 0589], Xi'an Jiaotong University; Luo Wanling [5012 8001 1545] and Dong Jingmin [5516 2417 3046], both of the Electric Power Testing Research Institute, Northwest Power Management Bureau (22)

Some Problems in Machining Large Synchronous Motor with Type TD 260/120-12......Li Fengzhu [2621 7685 3796], Harbin Electrical Machinery Plant (27)

JSHB Type Transistor Device Used as Out-of-step Protection and Automatic Resynchronization at Load for Synchronous Motors......Wang Jiarui [3769 1367 3843], Capital Iron and Steel Company (31)

The Problems Concerned with Selecting Water Turbine in the Region of Overlapped Heads......Huang Fenjie [7806 1164 2638], Department of Electric Power, Yunnan Institute of Technology (32)

An Increasing-pressure Device Used in the Model Hydro-turbine Test......Wang Shengyi [3769 4141 5030], Harbin Large Electrical Machinery Research Institute (37)

The Calculating Method and Analysis of Error at the Energy Test in Model Hydro-turbine......Li Jianwei [2621 1696 1218], Huazhong Institute of Technology (43)

The Main Points Using Special Elements of SAP-5 Program and Its Examples......Chen Yaomin [7115 5069 2404] and Liu Shunduo [0491 7311 6995], both of the Hangzhou Industrial Steam Turbine Research Institute (49)

9717
CSO: 4008/131

TABLE OF CONTENTS OF 'JILIANG JISHU' NO 1, 1982

Beijing JILIANG JISHU [MEASUREMENT TECHNIQUE] in Chinese No 1, 1982 on back cover

[Text] Main Contents

A Dynamic Measuring System for Position Finding by Laser Interferometry......Liu Xiangwen [0491 4382 2429], Yunnan Measuring and Testing Research Institute (1)

The Experimental Study for the Three-dimensional Optical-elastic Stress of the "Wheel" Type Load Cell......Zhang Hongmin [1728 1347 3046], Sun Jie [1327 3778] and Wang Xianyao [3769 7359 6460], all of the Taiyuan Institute of Technology (6)

The Development of Laser Power Stabilizer with $LiNbO_3$ Crystal......Yuan Hailin [5913 3189 2651], Qiu Huizhu [6726 1979 3796] and Luo Lin [5012 3876], et al., Shanghai Municipal Testing Research Institute and Shanghai Silicate Research Institute (11)

Some Problems in the Measurement of Optical Frequency...... Tu Shigu [1458 0013 6253], Shanghai Optical Instruments Research Institute, Chinese Academy of Sciences (15)

The PB Analogue Converter for Magnetic Measurement...... Yang Yongchang [2799 3057 1603] and Zhang Jiwu [1728 4480 2976], both of the Beijing Special Steel Mill Research Institute (19)

A Small Displacement Measuring Device--"Type CW1 Inductance Microcomparator"......Hao Ruixing, et al. (23)

The Application of Equation of Plan in Measuring the Geometric Dimensions of Double-directional Inclined Plane...... Zhang Youchang [1728 0642 2490] and Wu Tiecai [0702 6993 2088], both of the Shanghai Aeronautical Institute (35)

The Measurement of the Contact Lines and Base Spiral Angle of the Helical Gear......Xie Xiaofang [6200 1321 5364], Hangzhou Gearbox Plant (39)

The Measurement of FJ-21 Type Voltage Divider by a Resistive Method and Its Calculation......Sun Xianliang [1327 6343 5328] (44)

Application of Long Optical Grating with Digital Read-out in Large Toolmaker's Microscope......An Libang [1344 4539 6721], Yu Jianyuan [0205 1696 0337] and Zhang Songtao [1728 2646 3447], all of the Dalian Institute of Technology (45)

The Calibration of Electrodynamic Vibration Generator...... Xue Xinfa [5641 2450 3127], Beijing Municipal Metrology Bureau (47)

Repairing and Setting Up of Moving Coil Instruments...... Zhang Guanjiang [1728 7070 1730], Measurement Office, Hanzhong-Hanjiang Machine Tool Plant, Shaanxi (57)

9717
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PUBLICATIONS

TABLE OF CONTENTS OF 'LIXUE YU SHIJIAN' NO 1, 1982

Beijing LIXUE YU SHIJIAN [MECHANICS AND PRACTICE] in Chinese No 1, Feb 82 p 1

[Text] Current Development and Some Problems of Earthquake Mode......Guo Zengjian [6753 1073 1696], Lanzhou Seismological Research Institute, State Bureau of Seismology (2)

Mechanical Behavior of Materials at High Rates of Strain ......Wang Lili [3769 4409 4539], University of Science and Technology of China (9)

Introduction of Flow Visualization Technique......Yang Youqing, et al. (20)

Applied Research

Turbulent Flow in a Circular Pipe......Zhu Wenzhong [2621 2429 6850], Hunan University (27)

The Stress State of a Circular Tube on Two Supports Caused by Gravity......Zhang Zhonghua [1728 6945 5478], Chinese Metrological Research Institute (32)

The Calculation of Radial Pressure on the Mandrel of Collapse Winder......Zhou Guoying [0719 0948 4134], Shanghai Metallurgy and Design Research Institute (36)

The Loss Factor and Frequency of a Five-layered Viscoelastically Damped Beam......Ma Bang'an [7456 6721 1344], Institute of Mechanics, Chinese Academy of Sciences (39)

The Formation and Prevention of the Casting Initial Stress on Edges......Lu Yiting [7120 6318 1656], Zhu Liangjin [2612 5328 2516], Zhu Wancai [2612 8001 2088] and Zhu Chen [2612 3819], all of the Scientific Research Institute, Chengdu Survey and Design Institute, Ministry of Electric Power; Ma Can [7456 7515] and Su Chengji [5685 2110 0679], both of Institute 1010, Fourth Ministry of Machine Building (44)

A CO_2 Gas Dynamic Laser with Flow Rate of 10 kg/sec......
Chen Haitao [7115 3189 7290], Institute of Mechanics,
Chinese Academy of Sciences (50)

News in Brief on Programming...... (54)

Research on Education

Some Remarks on the Roles and Educational Policies of
Engineering Mechanics......Zhang Wei (56)

Teachers of Strength of Materials Should Have a Good Knowledge of the Fundamentals of Material Science and Engineering
......Hu Peiquan [5170 3099 3123], Northwest Institute of
Technology (58)

Inertial Force......Li Minqing [2621 3046 1987], South
China Mining and Metallurgy College (59)

Academic Discussion

Discussion of the Source of Energy for Structural Vibrations
Induced by the Moving Load......Chang Lianfang [1603 6647
2455], Wuhan College of Water Conservancy and Electric Power (62)

A Method of Constructing Special Solution of Plane-elasticity
in Polar Coordinates......Ding Haojiang [0002 3185 3068],
Zhejiang University; Wang Minzhong [3769 2404 0022] Beijing
University (68)

News and Trends

Investigation of the Aerodynamic and Thermal Effects of Roofing
Inlets in the Louver-type Ventilating System Used on Flat-roof
Buildings (Xue Huilian); A 5 m Vertical Shaft Wind Turbine
(Chen Qimin); Research on Making Full Use of the Wind Energy
(Chen Lingkang); Probe Used in Measuring Fluid Parameters
(Liu Jiancheng); Measuring Cantilever Beam Deflection (Yu
Zhongyao); Fatigue Strength Increase in Parts Due to Ultrasonic
Surface Treatment (Li Changjun); The Fastest Object on Earth
(Li Yuanhen); "Internal Wave" under Sea (Fu Yushou); A New
Device for Measuring Microflow of Fluid (Gu Lang)...... (78)

The Field of Mechanics

A Survey of Transonic Flow Research in China......Zheng Zhichu
[6774 0037 0443], Institute of Mechanics, Chinese Academy of
Sciences (70)

A Brief Account of the Mechanics Department of Beijing University......Wu Jike (72)

Experimental Water Tank of Zhongshan University......Hou Zemao (73)

Lectures on Fluid Mechanics and Mathematics......Dai Shiqiang, et al. (74)

Quizzes...... (75)

Bulletins...... (76)

9717
CSO: 4008/132

TABLE OF CONTENTS OF 'JIXIE ZHIZAO' NO 2, 1982

Shanghai JIXIE ZHIZAO [MACHINERY] in Chinese No 2, 1982 p 1

[Text] Features

Multitool and Multilayer Step Turning......Zhu Heng [2612 1854], Shanghai Electrical Machinery Plant (2)

Solving Off-center Problem in Key-way Milling......Wang Yuanqing [3769 0337 1987], Xiaoshan Power Machinery Plant, Zhejiang (4)

30th CMES Congress To Be Held in Shanghai...... (6)

Description of Maag Gear Shaper......Zhang Hualin [1728 5478 2651], Hubei Automotive Plant No 2 (7)

Steelband-type Protector for Precision Guide-ways......Liu Gendu [0491 2704 1653], Shanghai Level Plant (9)

A Production Line for Starting Motor Armatures......Yan Liang [0917 0081] and Dai Liang [2071 5328], both of the Shanghai Automotive Electrical Machinery Plant; Zhang Jiang [1728 3068], Science and Technology Information Research Institute, Shanghai Electrical Machinery Bureau No 1 (10)

A Self-centering Tool Support......Li Hongbin [2621 1347 2430], Shanghai Diesel Engine Plant (12)

Semi-automatic Graduating Machine......Ru Zhiming [5423 4160 2494], Pingwang General Machinery Plant, Jiangsu (13)

Measurement of Broken Trisected Circular Diameter......Tang Yuanxi [0781 0337 3356], Neijiang Cinema Company, Sichuan (17)

High Speed Thread Cutting Controlled by Microcomputer...... Yang Dianxuan [2799 3013 6693] and Wang Shizheng [3769 0013 2973], both of the Dalian Numerical Control Research Institute (18)

Application of Matrix in Mechanical Engineering......Cheng Zhouhe [4453 3166 3109], Shanghai Diesel Engine Plant (21)

Mechanism for Simple Harmonic Motion......Hua Danian [5478 1129 1628], East China Institute of Textile Technology (25)

Conical Friction Coupling and Its Design......He Qinsheng [0149 5367 3932], Shanghai Metallurgical and Mining Machinery Technology Research Institute (27)

Repair of an Oil Cracking Reactor by Welding......Deng Shaoxiong [6672 1421 7160] (29)

Calculation of Changing Gears for Helical Gear Hobbing with Large Odd N of T......Lu Yanlin [0712 3601 2651], Zhengzhou Water Conservancy Machinery Research Institute (30)

Application of LOR in Gas Carburizing Furnace......Zhu Zuchang [2621 4371 2490] (32)

Marketing and Selling--An Important Role in Management...... Chen Boying [7115 0130 5391] and Gu Zongtang [7357 1330 2768] (34)

Maintenance and Retrofit...... (36)

Shop Practices...... (5, 37, 38, 39)

Abstracts from Abroad...... (49)

Fundamentals in New Technology...... (43)

Mechanical English--No 2...... (47)

9717
CSO: 4008/133

AUTHOR: None

ORG: None

TITLE: "A Real-time Data Acquisition and Processing System for Measuring Spectrum Losses in Optical Fibers Developed"

SOURCE: Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 4, 20 Feb 82 pp 1, 15

TEXT OF ENGLISH ABSTRACT: A real-time data acquisition and processing system for measuring spectrum losses in optical fibers was developed recently by the Computer Application Division of Wuhan Research Institute of Post and Telecommunications Science. It is based on a Z-80 C computer and designed for on-line operation. One scanning can produce 22,500 samples. The sampling, computing and output are made simultaneously, and complete fiber-losses curves can be plotted out on an X-Y recorder at the end of scanning.

More than 100 fibers have been tested by this system which proved its effectiveness in improving test speed and product yield of optical fibers.

AUTHOR: None

ORG: None

TITLE: "A Computer-based Monitoring System for Textile Machines Has Passed Evaluation"

SOURCE: Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 4, 20 Feb 82 pp 1, 15

TEXT OF ENGLISH ABSTRACT: The computer-based monitoring system for textile machines used by Shanghai No 28 Textile Factory to control 504 machines in its present state passed evaluation in December 1981. This system was developed under the sponsorship of the China Computer Technical and Service Company and the Shanghai Textile Bureau. It uses a DJS 112 minicomputer and has run for more than 3000 hours without any failure.

A production efficiency improvement of 1.5 ~ 2 percent has been attained by installation of this system. The investment can be recovered in one year and three months through the added profits.

AUTHOR: None

ORG: None

TITLE: "A Microcomputer for Grouping Freight Trains"

SOURCE: Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 4, 20 Feb 82 pp 3, 15

TEXT OF ENGLISH ABSTRACT: The microcomputer ST-01A produced by Shanghai Factory of Communication Apparatus is used for grouping freight trains. It is simple to operate and is able to provide various data necessary for grouping freight trains correctly and promptly. By one touch of a key, three numbers are added or subtracted accumulatively. It can also be used for other computing and program control in chemical, metallurgical, commercial, storage and transportation enterprises by a slight change of program steps.

AUTHOR: None

ORG: None

TITLE: "Sino-Japanese Software Center Inaugurated"

SOURCE: Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 5, 5 Mar 82 pp 1, 20

TEXT OF ENGLISH ABSTRACT: The Sino-Japanese Software Center established in Beijing by joint efforts of the NEC and the China Computer Technology and Service Company to strengthen cooperation in the software area between China and Japan was inaugurated on 14 January and attracted the attention of many people from various countries.

It is the first software center established by China in cooperation with foreign countries. Its task includes providing computing hours for the users, training software personnel, maintaining ACOS machines, providing technical support and designing software systems, etc.

Two short-term courses for training managers and two other training courses for programmers and system analyzers will be given every year. One of the former will begin in May of 1982, and the latter two in February and August respectively.

AUTHOR: None

ORG: None

TITLE: "A Microcomputer-based Motor Performance Testing System"

SOURCE: Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 5, 5 Mar 82 pp 8, 20

TEXT OF ENGLISH ABSTRACT: A DJS-051B microcomputer-based test system was recently developed by Shanghai Motor Research Institute in cooperation with the Shanghai Computer Application Servicing Department. It is used for testing performance parameters of various motors.

The system was built around a DJS-051B computer and equipped with an A/D converter, a multichannel sampler, a printer, etc. It collects directly the motor's test parameters, makes data processing and prints out performance specifications of the tested motor instantaneously. The testing of a motor can be accomplished in half an hour compared with more than two days previously spent in manual tests. In addition, some parameters, such as the temperature profile within the motor, which cannot be obtained by manual readings may also be tested by the system.

AUTHOR: None

ORG: None

TITLE: "A New Electrostatic Plotter"

SOURCE: Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 5, 5 Mar 82 pp 10, 20

TEXT OF ENGLISH ABSTRACT: A new electrostatic plotter has been developed and two prototype machines have been produced by the Xian General Factory of Petroleum Surveying Instruments. The plotter has both graphic and character-printing capabilities. The speed for characters is 6943 words/s minimum and 14,000 words/s maximum, while the speed for graphics is 6980 line/m minimum and 19,500 line/m maximum.

The plotter has been proven stable and reliable during more than one year's operation, and has been put into volume production.

AUTHOR: None

ORG: None

TITLE: "China-made Computer Fitted with Imported EC-5561 Disk Driver"

SOURCE: Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 5, 5 Mar 82 pp 10, 20

TEXT OF ENGLISH ABSTRACT: The Institute of High Energy Physics successfully fitted China-made DJS-8 computers with the Romanian EC-5561 disk driver (equivalent to IBM-2314). The whole system went into on-line operation last year. In the system, an interface adapter concept is applied, so that either side to be interfaced is made transparent to the other side.

The disk sub-system, which is made up of 76 modules (all are standard DJS-8 plug-in modules except 14 MSI and thick film IC plug-in modules), can be incorporated into a standard DJS-8 small frame.

Through the interface adapter, various commands can be executed. The total storage capacity of the disk is 2 x 29 Mb.

9717
CSO: 4009/276

Engineering

AUTHOR: CHEN Tinghuai [7115 1694 2849]

ORG: Department of Computers and Automation, Chongqing University

TITLE: "Four-valued Logic and Star Algorithm"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 3, 1982 pp 1-28

TEXT OF ENGLISH ABSTRACT: Two-valued logic with elements "0," "1" is well known to everyone and it provides the implementations for studying propositional logic and logical networks. In this paper it has been extended to four-valued logic for the sake of describing the dynamic behavior of logical circuits. Its mathematical foundation has been studied, several normal forms have been introduced, the deduction methods of the Star algorithm have been dealt with and expansion theorem which attaches the Star algorithm to Boolean difference has been proved. The applications to several areas are also presented in this paper. First, the application to fault detection in combinational logical circuits is described in detail; the algorithm deriving tests is then presented by typical examples and is compared with the current D algorithm, Boolean difference method and ESP method by M. Fridrich. In fact, there are some advantages in the Star algorithm over the others. Finally, the possibility of the application to other areas in logical networks has also been pointed out. (The application to mathematical logics is omitted in this paper.)

AUTHOR: ZHANG Yanlin [1728 3601 2651]

ORG: Department of Computers and Automation, Chongqing University

TITLE: "A LISP Program of Star Algorithm"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 3, 1982 pp 29-40

TEXT OF ENGLISH ABSTRACT: In this paper a LISP program of the Star algorithm is proposed which has some advantages over the others--this program is brief and needs fewer memories and is more easily achieved on a microprocessor as a result of optimizing.

This program is used to automatically generate completely the fault test set for the given fault in a combinational logic circuit and to further establish the optimal fault test set.

Based on this program, it may be extended so that other programs generate fault tests for multiple fault and sequential circuits.

AUTHOR: ZHANG Zhimin [1728 1807 2404]

ORG: Department of Computers and Automation, Chongqing University

TITLE: "Application of Star Algorithm to Multiple Fault Detection in Combinational Circuits"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 3, 1982 pp 41-61

TEXT OF ENGLISH ABSTRACT: This paper deals with the application of the Star algorithm to test generation for the specified multiple faults in combinational circuits. At the beginning, the main results of the Star algorithm are outlined, and then some formulas and theorems used in this paper are derived. The procedure for finding tests for the specified multiple faults in combinational circuits by using the Star algorithm is described in detail. Based on this, the algorithm by which the complete test sets for combinational circuits can be generated on the assumption that at most M simultaneous faults may occur is presented. Afterwards it is compared with the Boolean difference used to solve the same problem. It is obvious that the method proposed in this paper has more advantages.

AUTHOR: ZHANG Zhimin [1728 1807 2404]
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ORG: Both of the Department of Computers and Automation, Chongqing University

TITLE: "A Near Optimal Algorithm for Test Generation in Sequential Circuits--The Star Algorithm"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 3, 1982 pp 62-76

TEXT OF ENGLISH ABSTRACT: In this paper we discuss how to apply the Star algorithm to test generation for sequential circuits. The circuit tested may be asynchronous. The basic logic unit may be gate-level or function-level. In addition, the algorithm is capable of self-initialization. First we outline the main results of the Star algorithm, and then, by examples, describe the procedure by which the tests of a sequential circuit can be generated. Afterwards we compare it with the D algorithm and the Nine-valued algorithm. The Star algorithm seems to have more advantages than do the others.

AUTHOR: YUAN Youguang [5913 3945 0342]
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ORG: Both of the Department of Computers and Automation, Chongqing University

TITLE: "The Methodology of Dynamic Testing for Combinational Logic Circuits"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 3, 1982 pp 77-89

TEXT OF ENGLISH ABSTRACT: The dynamic testing of combinational logic circuits is studied systematically, and the methods for generating the complete test set of a dynamically detectable fault as well as hazardously detectable statically undetectable fault are discussed in this paper. First, we find out a new and systematical approach to identify all hazards of a given logic circuit on the basis of the "Four-valued Logic and Star Algorithm," then derive formulas of hazardous tests for single or multiple stuck-at faults and for bridging faults which are undetectable statically, and a number of examples are given.

AUTHOR: SHI Weigeng [0670 4850 2577]

ORG: Department of Computers and Automation, Chongqing University

TITLE: "Minimal Multiple Fault Tests for Combinational Circuits"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 3, 1982 pp 90-111

TEXT OF ENGLISH ABSTRACT: In order to obtain a minimal multiple fault test for combinational circuits, this paper gives an algorithm. The algorithm divides a combinational circuit into sub-tree circuits and different levels. For this reason, the amount of work of the Star algorithm will be reduced. In the algorithm, redundant and irredundant circuits need not be differentiated.

AUTHOR: LIU Zhimo [0491 1807 2875]

ORG: Department of Computers and Automation, Chongqing University

TITLE: "Using Independent Variables for Simplifying Test Generation in Logic Networks"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 3, 1982 pp 112-120

TEXT OF ENGLISH ABSTRACT: This paper is concerned with the structure analyses of logic networks. A kind of independent variable (abbreviated INDV) in the networks is defined. Using INDV, test generation can be simplified into two aspects: one is the dimension-reduced method, the other is using a known test to generate a new test for an uncovered fault. The proposed method can be implemented in any exploratory algorithm.

AUTHOR: ZHANG Yanlin [1728 3601 2651]

ORG: Department of Computers and Automation, Chongqing University

TITLE: "A Module-Two Model of Fault Diagnosis of Digital Systems"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 3, 1982 pp 163-175

TEXT OF ENGLISH ABSTRACT: In this paper a new theoretical model of automatic fault diagnosis for the digital systems is proposed in which the set of test outcomes tallies with the module-two operation. The necessary and sufficient conditions of fault syndrome in this model have been discussed. It has been proved that any digital system which is suited to the module-two model has the one-step fault diagnosability if the number of fault units is less than half of the total units. It is shown that determining the most likely consistent fault sets is equivalent to solving a module-two linear programming problem. Based on this analysis, the author has obtained an effective method and its APL program for correctly detecting consistent fault sets, and proved that the space-time complexity of this algorithm is linear. Finally, this model has been extended to probabilistic fault diagnosis. In fact, there are some advantages in module-two model over the others.

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TITLE: "Hazard Identification in Combinational Logic Circuits"

SOURCE: Chongqing CHONGQING DAXUE XUEBAO [JOURNAL OF CHONGQING UNIVERSITY] in Chinese No 3, 1982 pp 176-193

TEXT OF ENGLISH ABSTRACT: In this paper the dynamic behaviors of combinational logic circuits are investigated, the algebraic structures related to various hazards are set up and a new and systematic approach to identify hazards is proposed. It not only points out explicitly all transient input assignments to make the output of the logic networks to produce static o-hazard, static 1-hazard, dynamic step-down hazard and dynamic step-up hazard, but also causes the number of transient input assignments which are needed to be verified for differentiating a kind of hazard to be considerably reduced. This technique could be easily implemented in a computer program.

9717
CSO: 4009/278

AUTHOR: HU Haichang [5170 3189 2490]

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TITLE: "On the Rational Utilization of Generalized Variational Principles for Approximate Solutions

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 1, 1982 pp 1-17

TEXT OF ENGLISH ABSTRACT: Although in the approximate solution of problems of elasticity by generalized variational principles it is allowed to make individual assumptions about displacement, stress and even strain, these assumptions should not be absolutely independent in order to obtain a rational model in mechanics. They must suit each other in the sense that every mechanical quantity is able to do some amount of work in certain cases. When the work requirement is fulfilled, all the energy principles (theorems) in elasticity remain valid in the approximate model. Otherwise one, and possibly all the energy principles (theorems) may be invalid. Quantitative indexes are proposed for the ability of doing the work of some fundamental mechanical quantities, by which the suitability of a set of assumptions may be estimated.

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TITLE: "Secondary Vortex and the Process of the Formation of the Karman Vortex"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 1, 1982 pp 18-25

TEXT OF ENGLISH ABSTRACT: In this paper we have studied and formulated the formation, growth and effect of the secondary vortex in the near wake of a circular cylinder, which is impulsively started from the rest and subsequently moves with constant velocity, studied the immediate cause leading to the instability of the motion of symmetric main vortices and described the process of the formation of the Karman vortex. These numerical results are given. In the present work a method is used that combines the discrete vortex model with the boundary layer theory, boundary layer separation and real shear layer separation, which are simultaneously taken into account. In this paper we suggest that under the effect of the secondary vortex, while the symmetric main vortices from the situation having a supplement in vorticity change into a free vortices situation having no supplement in vorticity, the condition that leads to the instability of the motion of symmetric

[Continuation of LIXUE XUEBAO No 1, 1982 pp 18-25]

main vortices has just appeared. Then under the action of a small disturbance the fluctuation motion may be produced and further development leads to Karman vortex motion. In the present work the flow is considered to be laminar and the Reynolds number is high. The results given by the present work look very much like the observed features in the flow field visualization.

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YU Dasen [0060 1129 2773]
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ORG: All of the Lanzhou Division of Mechanics of Flow Through Porous Media, Chinese Academy of Sciences

TITLE: "The Physical Characteristics of the Porous Media Concerning Flow in Viscera"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 1, 1982 pp 26-33

TEXT OF ENGLISH ABSTRACT: The physical characteristics of seven tubule systems existing in four viscera (i.e., blood vessel systems of kidney, lung, liver and heart, urinary tubule system of kidney, pulmonary alveole-bronchus system of lung and bile tubule system of liver) were investigated, starting from the concept of porous media and the viewpoint of flow through porous media.

Observations were made by applying colored macrography and micrography (i.e., optical microscopy and scanning electron microscopy) to the macroscopic and microscopic stereo casting samples and the microscopic thin slices of the casting samples of the aforementioned tubule systems. Corresponding calculations were carried out.

[Continuation of LIXUE XUEBAO No 1, 1982 pp 26-33]

In the present paper some main results of our research are given briefly and the conclusions are as follows: The seven above-mentioned tubule systems possess the two necessary characteristics of porous media, namely, the tiny equivalent diameters of tubules and the great specific surface, the specific value and magnitude of which are analogous to that of the typical porous media-sandstone. This means that the flow in these seven systems can be regarded as flow through porous media, and the relevant fluid mechanics problems in such systems may be treated as problems in flow through porous media.

AUTHOR: JIANG Jinliang [5592 6930 5328]

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TITLE: "Numerical Computation of the Viscous Compressible Flow in Turbomachinery. (II) Computation of Axisymmetrical Flow in the Rotor"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 1, 1982 pp 34-41

TEXT OF ENGLISH ABSTRACT: The numerical method for computing the viscous compressible steady laminar flow in turbomachinery is applied to a rotationary coordinate system in this paper. Fundamental equations of the viscous compressible flow in the rotor are introduced. Then, the numerical solution of the viscous axisymmetrical flow in the rotor is obtained by iterative computation based on the enthorpy gradient equation, energy equation and entropy equation, expressed along arbitrary curved lines.

AUTHOR: GAO Zhi [7559 2535]

ORG: Institute of Mechanics, Chinese Academy of Sciences

TITLE: "A Kinetic Approach to Radiative Nonequilibrium Flow with Application to Gas Flow Lasers"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 1, 1982 pp 42-54

TEXT OF ENGLISH ABSTRACT: A kinetic approach to radiative nonequilibrium flow of lasing gas is presented. We introduce a new gain related to molecular speed (GMS) and develop an approximate method of solution. These treatments make it possible to describe exactly the interaction between radiation field, macroscopic flow and microscopic molecular motion. In the case of CO_2 gas flow lasers, the zero-order solutions of this theory are already satisfactory in that they are valid for the whole pressure range. The results of the zero-order solutions agree well with numerical results, and are in accordance with those of the currently accepted rate-equation theory in high pressure range. For zero flow speed, this theory leads to the well known theory of non-flow gas lasers. One of the present conclusions is especially worth noting, i.e., the rate-equation theory, in which the line shape factor was introduced, although it cannot correctly account for the effects of inhomogeneous broadening. For example, for $\eta = 0.02$, $\bar{I}_R/\bar{I}_K$ is about 8 for $\xi = 0$ and 20 for $\xi = 1.0$, where η is the broadening parameter, ξ the frequency shift parameter, $\bar{I}_R$ and $\bar{I}_K$ the dimensionless intensities of RET and this theory respectively.

AUTHOR: LI Kaitai [2621 7030 3141]
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TITLE: "Partial Differential Equation Satisfied by Stream Functions in Three-dimensional Turbomachine Flow and the Finite Element Solution"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 1, 1982 pp 55-62

TEXT OF ENGLISH ABSTRACT: By applying a semi-geodesic coordinate system and tensor analysis, this paper deduces a partial differential equation satisfied by stream function on any stream surface, including the S_1 surface, S_2 surface or another stream surface, proves rigorously certain properties of stream function and obtains boundary conditions for the stream function.

The paper also defines a weak problem associated with the boundary value problem for quasilinear elliptic partial differential equations and provides an algorithm of a finite element solution.

The establishment of this partial differential equation has brought about a unified method to find the flow solution on any stream surface. Therefore, a unified program can be established to realize alternative iteration between S_1 and S_2 based on Wu's theory.

AUTHOR: YIN Youquan [3009 2589 3123]
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ORG: Both of Beijing University

TITLE: "Elastoplastic Coupling and Generalized Normality Rule"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 1, 1982 pp 63-70

TEXT OF ENGLISH ABSTRACT: In this paper the strain increment $d\varepsilon$ during a yielding process is conceived as consisting of a reversible part $d\varepsilon^R$ and an irreversible part $d\varepsilon^I$. The former represents the strain increment which vanishes after the yield-generating stress increment $d\sigma$ is removed. It is related to $d\sigma$ through Hooke's law, but the elastic module may be a function of the plastic internal variables, thus it exhibits elastoplastic coupling. The irreversible part $d\varepsilon^I$ can be regarded as composed of a conventional plastic part $d\varepsilon^P$ and a coupled part $d\varepsilon^C$ due to the change in elastic moduli. According to Ilyushin's postulate of plasticity, a generalized normality rule can be established, that is, the irreversible strain increment vector $d\varepsilon^I$ points in the outward normal direction of the loading surface in the stress space. It follows from this rule that the directions of the conventional plastic strain increment $d\varepsilon^P$ and the outward normal one of the loading surface do not coincide and they are related by a coupling matrix K which depends on the coupling properties, definitions of the internal variables and the yield

[Continuation of LIXUE XUEBAO No 1, 1982 pp 63-70]

function. When there is no coupling, K reduces to a unit matrix and $d\varepsilon^I = d\varepsilon^P$, and the rule reduces to the usual normality rule (associated flow rule). In addition, the loading criteria and the constitutive relation in the coupled case are given. Thus the classical plasticity constitutive theory can be generalized to cover the cases of strain softening and elastoplastic coupling. The theory is used to model elastoplasticity for rock-like materials and to solve the rock engineering problems by the finite element method.

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ORG: Northwestern Polytechnical University

TITLE: "On the Shear Center of a Prismatic Bar with T- and [-Cross Section"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 1, 1982 pp 71-81

TEXT OF ENGLISH ABSTRACT: This paper is a continuation of the author's previous work When solving the Saint Venant bending problem of a prismatic bar with T- and [-cross sections, using a simple substitution we can convert the boundary value problem of the stress function $\phi(x, y)$ into a Dirichlet problem of harmonic function. Then, dividing the considered region into several rectangular sub-regions and placing several undetermined functions on dividing lines and using the continuation theorem of harmonic function, we can solve the considered boundary value problem and obtain the equation for calculating the coordinates of the shear center. Numerical results obtained are shown in the tables.

From our practice it is proved that the technique proposed is more convenient than those of: (1) the Ritz method, (2) Trefftz's method, (3) Swartz's alternating method and (4) a technique proposed by Arutyunyan, who reduced the boundary value problem into some ordinary differential equations.

AUTHOR: GU Qiulin [7357 3061 2651]

ORG: Qinghua University

TITLE: "A General Asymptotic Analytical Solution of Plane Problem of Elastoplasticity with Strain-hardening"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 1, 1982 pp 82-89

TEXT OF ENGLISH ABSTRACT: In this paper a general asymptotic analytical solution of a plane problem (including plane stress and plane strain) of elastoplasticity with strain-hardening by perturbation method is suggested while the stress-strain relation of the material is expressed by a power series. The method is applicable to all cases with known elastic solution. The example of a thick-wall cylinder with uniform internal pressure shows that the method suggested in this paper is reliable.

AUTHOR: HE Shiping [0149 0013 1627]
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TITLE: "Investigation of Crack-tip Strain Field by Magnification of Laser Speckle Photography and Sandwich Specklegram"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 1, 1982 pp 90-96

TEXT OF ENGLISH ABSTRACT: In this paper, magnification of laser speckle photography and sandwich specklegram is studied. The former may be used to measure strain distribution in an area within 1 mm from a crack-tip. The latter seems to be convenient when it is applied to measuring strain distribution successively when the loads are increased step by step. Having used these techniques, the strain distribution and its variation with respect to time were measured in an area within 1.7 mm/1.5 mm around the crack-tip. The experimental results are presented. In addition, photographs of pinholes appearing successively in front of the crack-tip during the process of fracturing are also presented.

AUTHOR: WANG Boyi [3769 2672 2034]

ORG: Institute of Mechanics, Chinese Academy of Sciences

TITLE: "Iridium Electrostatic Probe and Its Application in a High Temperature Wind Tunnel"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 1, 1982 pp 97-103

TEXT OF ENGLISH ABSTRACT: This paper describes a kind of electrostatic probe which can be used to measure parameters of high temperature gas flow, such as electron density, electron temperature, etc. It also gives theoretical curves of probe characteristic for air plasma. This iridium electrostatic probe has been operated successfully in an arc-heated tunnel.

AUTHOR: KANG Shouwan [1660 1108 8001]

ORG: Institute of Mechanics, Chinese Academy of Sciences

TITLE: "One-dimensional Steady and Unsteady Flow of Viscous Conducting Incompressible Fluid"

SOURCE: Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese No 1, 1982 pp 104-109

TEXT OF ENGLISH ABSTRACT: The boundary condition of one-dimensional channel flow of viscous conducting fluid is examined. With a similar boundary condition, $H_x(y = \pm a) \neq 0$, the steady flow problem (Hartmann flow) is investigated. In addition, using the Fourier sine transform method, we have obtained the exact solution of unsteady flow.

9717
CSO: 4009/275

Metallurgy

AUTHOR: HE Xinlai [6320 0207 5490]
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TITLE: "The Non-equilibrium Segregation of Boron to Austenite Grain Boundaries"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 1, Feb 82 pp 1-10

TEXT OF ENGLISH ABSTRACT: By means of high resolution particle-tracking autoradiography the regularity of boron segregation to austenite grain boundaries has been studied, and the boron concentration profiles across segregated grain boundaries and characteristic parameters for non-equilibrium grain boundary segregation (width of boron-depleted zone, degree and width of boron-segregated band) have been measured. It has been shown that this kind of grain boundary segregation has the following features:

There exists a boron-depleted zone adjacent to the segregated grain boundary, which is responsible for supplying boron to the grain boundary during cooling. This kind of segregation during cooling is very sensitive to the cooling rate. Rapid cooling can inhibit it, and the segregation state would progressively develop from continuous band to discontinuous aggregation and even apparent precipitation as the cooling

[Continuation of JINSHU XUEBAO No 1, Feb 82 pp 1-10]

rate decreases. The width of boron-depleted zone is inversely proportional to the square root of the cooling rate. The temperature relationship of segregation is opposite the expectation of the equilibrium grain boundary segregation. The higher the quenching temperature, the more incremental are the segregated degree and the width of the boron depleted zone.

The test has demonstrated that boron segregation at austenite grain boundaries in quenched steel is a non-equilibrium grain boundary segregation phenomenon which occurs during cooling.

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TITLE: "The Mechanism of Non-equilibrium Segregation of Boron to Austenite Grain Boundaries"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 1, Feb 82 pp 11-20

TEXT OF ENGLISH ABSTRACT: It has been demonstrated that the boron segregation at austenite grain boundaries in quenched steel is a non-equilibrium grain boundary segregation phenomenon occurring during cooling. In this paper, by way of resolving nonisothermal diffusion equation, a theoretical formula for non-equilibrium grain boundary segregation has been derived, and the relationship among the width of the boron depleted zone, quenching temperature, cooling rate, activation energy and diffusion constant of the non-equilibrium grain boundary segregation has been established. The theoretical prospects agree with experimental results satisfactorily.

From experimental results and theoretical analysis, an atomic model for non-equilibrium grain boundary segregation has been suggested based on the moving of

[Continuation of JINSHU XUEBAO No 1, Feb 82 pp 11-20]

boron atoms along with supersaturationies vacancies or divacancies to grain boundaries (sink of vacancy) during cooling. In light of this new idea of non-equilibrium grain boundary segregation, the complicated effects of boron on the hardenability of steel can be explained unambiguously.

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TITLE: "Internal Friction Associated with the Martensitic Transformation of AuCd Alloys"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 1, Feb 82 pp 21-29

TEXT OF ENGLISH ABSTRACT: The height of the Q^{-1} peak due to martensitic transformation in AuCd alloys increased significantly in successive measuring runs. It was found to be related to the increase of interfaces of the parent-martensite according to metallographic examination. The authors put forward a model based on the hysteresis loss mechanism associated with stress-induced motion of the interface dislocations. A new Q^{-1} peak above M_s was observed. It was confirmed to be a relaxation peak due to a certain thermal activation process. For AuCd (46.1 at.-percent Cd) alloy, normal bcc $\rightleftharpoons$ orthorhombic transition changed to bcc $\rightleftharpoons$ hexagonal transition after one to two measuring runs. It is suggested that defects play a central role in the change.

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TITLE: "Formation of μ-phase and Its Effect on Mechanical Properties of Cast Nickel-base Superalloys"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 1, Feb 82 pp 30-37

TEXT OF ENGLISH ABSTRACT: Studies were made of the formation and chemical composition of precipitated plate-like μ-phase as well as its effect on the TTT curve, fracture feature and mechanical properties of cast nickel base superalloy. It was found that the temperature of formation of plate-like μ-phase is within a wide range, from 800 to 1140°C. Its baseplane is parallel to the hexagonal plane {0001}. It precipitates from plane {111} of the γ-matrix. The cleavage fracture feature under impact, tensile and stress tests below 760°C appears along baseplane {0001} of the μ-phase. For the superalloy containing 1 - 1.5 wt-percent μ-phase, the impact value at 20°C, the stress rupture life and the tensile ductility at 20°C and 760°C decrease obviously, but the stress rupture ductility increases distinctly, especially under elevated temperatures. The $\bar{N}_v$ value seems not to be the only factor to control the μ-phase formed, and relates to both (Mo+W) at.-percent and Mo/(Mo+W). In addition, the boron content may also be effective in retarding its formation.

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TITLE: "Effect of the Mode of Overload on the Behavior of Fatigue Crack Propagation"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 1, Feb 82 pp 38-46

TEXT OF ENGLISH ABSTRACT: The effects of different modes of overload, including tensile, compressive, tensile-compressive and compressive-tensile, on the behavior of fatigue crack propagation in LY12 Al alloy were investigated. From a study of the changes in micro-morphology, the plastic zone size and strain distribution around the crack tip and the fracture analysis before and after various overloadings, it is suggested that various modes of overload produce different influences on FCP, and the retardation behavior of FCP after tensile overloading may be described as a combination effect of several factors acting on the crack tip and its surrounding region. A general mechanism of the effect of tensile overload on FCP behavior is proposed.

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TITLE: "Mechanism of Hydrogen Induced Delayed Plasticity"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 1, Feb 82 pp 47-57

TEXT OF ENGLISH ABSTRACT: For various carbon and low-alloy steels with a wide range of tensile strength, the effect of hydrogen on the apparent yield stress, which is a necessary exterior stress to produce the local macroscopic plastic deformation, was investigated with smooth tensile, bending, pre-cracked I, type III and combined type I+III specimens. The results show that the effect of hydrogen on the yield strength of a smooth tensile specimen is insignificant, the difference between the charged and uncharged specimens being less than 10 percent. However, for the smooth bending or pre-cracked type I specimen with a tensile stress gradient, hydrogen can decrease the apparent yield stress considerably if the strength of steel and the amount of hydrogen entering into the specimen exceed their critical values. This is the cause of hydrogen induced delayed plastic deformation and hydrogen induced delayed cracking.

[Continuation of JINSHU XUEBAO No 1, Feb 82 pp 47-57]

The effect of hydrogen on the apparent yield stress increases with increasing strength of the steel and average hydrogen concentration in the specimen. The reduction of the apparent yield stress of charged pre-cracked specimens is more evident than that of smooth bending ones. The hydrogen induced apparent yield stress reduction is a phenomenon controlled by hydrogen diffusion that depends markedly on the strain rate and test temperature.

For type III cracked specimens in which there is no hydrostatic stress, the apparent torsional yield stress of the charged specimens does not decrease and $K_{IIIH} = K_{IIIC}$. But hydrogen induced delayed plasticity and cracking can occur on the specific plane inclined at an angle of -45° to the original crack plane. For combined type I+III specimens, the apparent torsional yield stress can be decreased only when K_I is so large that hydrogen induced delayed plasticity can occur under the action of K_I itself.

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TITLE: "An *In Situ* Study of Crack Nucleation and Propagation in Pearlite during Deformation"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 1, Feb 82 pp 58-63

TEXT OF ENGLISH ABSTRACT: The microprocess of deformation and fracture of structural steels containing 0.15, 0.45 and 0.79 percent C respectively have been examined by tensile testing on SEM. For steel specimens 15 and 45, it was observed that the deformation is mainly undergone in proeutectoid ferrite, as well as shear, multiple-slip and colony rotation exhibited in pearlite. The crack is almost entirely nucleated at the interface of the inclusion/matrix or pearlite/ferrite. The fracture mode is ductile. In specimens of eutectoid steel T8, the cementite lamellae may be plastically deformed to some extent, and its tendency increases with the decrease of interlamellar spacing. When the microstructure contains fine pearlite, a uniform strain distribution and a wider strain range as well as slip and bending phenomena of cementite lamellae have been observed. Fracture is of ductile characteristic. On the other hand, coarse pearlite deforms more

[Continuation of JINSHU XUEBAO No 1, Feb 82 pp 58-63]

inhomogeneously with localized strain in intense shear bands. The crack nucleation is initiated by cracking of cementite lamellae along shear bands. The fracture is brittle. The cracking phenomenon along shear deformation bands in cementite lamellae is discussed by the authors in reference to the model of pile-up dislocations.

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TITLE: "The Effect of Zr on the Grain Growth Behavior and Properties of Fe-Ni-Co-Cu Type Alloys"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 1, Feb 82 pp 64-74

TEXT OF ENGLISH ABSTRACT: In order to control the quality induced by the grain growth during high temperature annealing of Fe-Ni-Co-Cu type alloys, Zr modification can effectively control the grain size to ASTM grade 5 to 6 during annealing at 1050°C.

The form of existence of Zr in the alloys is investigated in searching for the mechanism of grain growth retarded by Zr. The effect of the structure and size of particles formed by Zr on retarding the grain boundary mobility is analyzed and the factors influencing the effect of Zr retarding grain growth are discussed.

It is shown that the addition of Zr in these alloys has improved the properties concerned with grain refinement, such as the characteristics of the grain boundary penetration by brazing alloys, workability, chemical stability, anti-SCC ability, etc., and has had little effect on its thermal expansion, mechanical properties

[Continuation of JINSHU XUEBAO No 1, Feb 82 pp 64-74]

and weldability by TIG welding. These alloys modified by a proper amount of Zr showed good performance during application to instruments and apparatus.

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TITLE: "A Study of Dual-phase Steel 20"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 1, Feb 82 pp 75-84

TEXT OF ENGLISH ABSTRACT: A study was made of the microstructure, properties and deformation behavior of intercritically quenched ferrite-martensite dual-phase steel 20 under cold-rolling. The results indicate that both structure and properties of martensite and ferrite phases are quite different from those of single-phase ones. The conventional mixture law, which is commonly used to evaluate the strength of the fiber-reinforced composite materials, seems not to be applicable. The model of deformation of the dual phase steel 20 in the process of cold rolling may be proposed by a gradual transition from stress-equal model at the start to strain-ratio-equal model at the later stage. Its work-hardening may be attributed to a change from non-equal strengthening state of strength-ratio-equal state. A summarized plot for its deformation behavior during cold-rolling is also given to explain rather easily the relative variation of the structure and properties of each phase in the whole process.

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TITLE: "Influence of Cr on 'Softening Effect' of 30CrNi5MoV Steel"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 1, Feb 82 pp 85-94

TEXT OF ENGLISH ABSTRACT: The influence of Cr content on the softening effect of 30CrNi5MoV steel was investigated by using optical microscopy, TEM and phase analysis. The conditional proportion limit, $\sigma_{p_{50}}$, of the steel falls sharply as the Cr content increases in the range of 0.22 - 1.61 percent when the other experimental conditions are the same. It was deduced that its falling rate is

[Continuation of JINSHU XUEBAO No 1, Feb 82 pp 85-94]

expressed as $\sigma_{p_{50}}$ = 1352-245xCr percent. The softening effect may result substantially from the Cr changing the solubility of the solute in α-ferrite, which coarsens the martensitic substructure and reduces the ratio of the grain size of carbides to their interparticle spacings.

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TITLE: "Microstructural Stability and Its Influence on Embrittlement of Ferritic-Austenitic Stainless Steel 00Cr18Ni5Mo3Si2"

SOURCE: Shenyang JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese No 1, Feb 82 pp 95-103

TEXT OF ENGLISH ABSTRACT: The influence of the microstructural stability on the embrittlement in ferritic-austenitic stainless steel, 00Cr18Ni5Mo3Si2, was investigated. After the solution was treated at 980°C and subsequently aged between 450-900°C, the steel underwent two types of transformations, namely $\alpha \rightarrow \gamma' + \chi(\sigma)$ and $\alpha \rightarrow \alpha' +$ precipitates of intermetallic phases. During aging in the temperature range of 450-750°C, the lamellar intermetallic phase, $Fe_3Cr_3Mo_2Si_2$, precipitates preferentially along grain boundaries and a topological close-packed phase, $Fe_{2.4}Cr_{1.3}MoSi$

[Continuation of JINSHU XUEBAO No 1, Feb 82 pp 95-103]

(R phase) appears in the ferrite grains. At 750-900°C the χ phase is merely a metastable one which changes easily to σ phase. A study was also made of the kinetic curve of isothermal decomposition of α-ferrite. The results indicate that the fracture feature of the steel between 550-650°C is quite different from that between 800-900 °C. In the range of 550-650°C, the intergranular brittle fracture is caused substantially by the precipitation of the lamellar intermetallic phase $Fe_3Cr_3Mo_2Si_2$ arranged regularly along grain boundaries, but in 800-900°C, the quasi-cleavage fracture is connected to the lumpy precipitates of the σ and χ phases.

9717
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TITLE: "Design and Development of Acoustic Emission Monitor"

SOURCE: Shanghai WUSUN JIANCE [NONDESTRUCTIVE TESTING] in Chinese No 1, 1982 pp 1-5

TEXT OF ENGLISH ABSTRACT: This paper introduces the general structure of acoustic emission monitor and the development of domestic instrumentation as well as the design and experimental results of the four-channel acoustic emission pulse analyzer SFS-4. The latest techniques abroad, such as "adaptive threshold," "weighted ring-down counting," are applied for the first time, by which new characteristic parameters are added with improved anti-interference ability and increased application of the instrument. The future development of acoustic emission monitor is also discussed.

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TITLE: "Inspection of Surface Defects in Valve Springs with Ultrasonic Surface Wave"

SOURCE: Shanghai WUSUN JIANCE [NONDESTRUCTIVE TESTING] in Chinese No 1, 1982 pp 6-9

TEXT OF ENGLISH ABSTRACT: The principle and method for the inspection of surface defects in valve springs are introduced. It is proved by practice that the quality of valve spring surfaces has been ensured and the production efficiency has been raised after the application of ultrasonic surface wave technique instead of magnetic testing.

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TITLE: "Preliminary Experiments of the LNN Piezoelectric Ceramic Ultrasonic Probe with High Resolution and Small Dead Zone"

SOURCE: Shanghai WUSUN JIANCE [NONDESTRUCTIVE TESTING] in Chinese No 1, 1982 pp 10-12

TEXT OF ENGLISH ABSTRACT: This paper describes the ultrasonic probe with high resolution and small dead zone made of lithium-sodium niobate piezoelectric ceramic as well as its fabricating process. Experimental results for testing various metallic parts, such as the 5F6 model tool steel forgings and other aircraft parts, are given. Testing on standard samples and applications have shown that good testing results can be obtained with the combination usage of the probe and a type CTS-6 ultrasonic flaw detector.

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TITLE: "Nondestructive Hardness Testing of Connecting Rod Bolt for Diesel Engines"

SOURCE: Shanghai WUSUN JIANCE [NONDESTRUCTIVE TESTING] in Chinese No 1, 1982 pp 18-20

TEXT OF ENGLISH ABSTRACT: This article describes the principle, construction and operation of a nondestructive inspection instrument, the operation of which depends on the variation of AC magnetic permeability, for measuring the hardness of quenched and tempered 35CrMo steel. Practical application proves that the instrument is very sensitive to differences in steel types and can also indicate the corresponding differences in hardness values. The instrument can be used as a practical means for 100 percent inspection of heat-treated parts.

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TITLE: "Discussion of Basic Principle of Radiographic Inspection--The Construction of Exposure Chart for Flaw Detection by Cs^{137}"

SOURCE: Shanghai WUSUN JIANCE [NONDESTRUCTIVE TESTING] in Chinese No 1, 1982 pp 21-25, 30

TEXT OF ENGLISH ABSTRACT: By analyzing the process for constructing the chart for Cs^{137} radiography, the paper concludes that wide beam γ-ray is the theoretical basis of radiographic inspection and the construction of the exposure chart and that the control of the amount of radiation to the film is one of the important factors in performing the radiographic process.

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